WHAT IS CLAIMED IS:

1. A projection optical system for forming a reduced image on a first plane onto a second plane, comprising:

a first reflective image forming optical system that forms an intermediate image of the first plane, and a second reflective image forming optical system that forms an image of the intermediate image on the second plane, wherein:

the first reflective image forming optical system has, in order of an incidence of light from a side of the first plane, a first reflective mirror M1, an aperture stop, a second reflective mirror M2, a third reflective mirror M3, and a fourth reflective mirror M4, and

the second reflective image forming optical system has, in order of the incidence of the light from the side of the first plane, a fifth reflective mirror M5 and a sixth reflective mirror M6.

2. The projection optical system of claim 1, wherein a maximum incident angle A of a light beam to each of the reflective mirrors M1-M6 satisfies, at each of the reflective mirrors M1-M6, a condition:

$$A < 25°.$$

3. The projection optical system of claim 1, wherein at each of the reflective mirrors M1-M6,

$$\phi M / | R | < 1.0$$

is satisfied, where ϕM is an effective diameter of each of the reflective mirrors M1-M6 and R is a curvature radius of a reflective surface of each of the reflective mirrors M1-M6.

4. The projection optical system of claim 2, wherein at each of the reflective mirrors M1-M6,

$$\phi M / | R | < 1.0$$

is satisfied, where ϕM is an effective diameter of each of the reflective mirrors M1-M6 and R is a curvature radius of a reflective surface of each of the reflective mirrors M1-M6.

5. The projection optical system of claim 1, wherein a slope α of luminous flux from the first plane to the first reflective mirror M1 with respect to an optical axis of a main light beam satisfies

$$5° < | \alpha | < 10°.$$

6. The projection optical system of claim 2, wherein a slope α of luminous flux from the first plane to the first reflective mirror M1 with respect to an optical axis of a main light beam satisfies

$5° < |\alpha| < 10°$.

7. The projection optical system of claim 3, wherein a slope α of luminous flux from the first plane to the first reflective mirror M1 with respect to an optical axis of a main light beam satisfies

$5° < |\alpha| < 10°$.

8. The projection optical system of claim 4, wherein a slope α of luminous flux from the first plane to the first reflective mirror M1 with respect to an optical axis of a main light beam satisfies

$5° < |\alpha| < 10°$.

9. The projection optical system of claim 1, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

10. The projection optical system of claim 2, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

11. The projection optical system of claim 3, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

12. The projection optical system of claim 4, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

13. The projection optical system of claim 5, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

14. The projection optical system of claim 6, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

15. The projection optical system of claim 7, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

16. The projection optical system of claim 8, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$\phi M \leq 700$ mm.

17. The projection optical system of claim 1, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

18. The projection optical system of claim 2, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

19. The projection optical system of claim 3, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

20. The projection optical system of claim 5, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

21. The projection optical system of claim 9, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

22. The projection optical system of claim 1, wherein the projection optical system is substantially telecentric on the second plane side.

23. The projection optical system of claim 2, wherein the projection optical system is substantially telecentric on the second plane side.

24. The projection optical system of claim 3, wherein the projection optical system is substantially telecentric on the second plane side.

25. The projection optical system of claim 5, wherein the projection optical system is substantially telecentric on the second plane side.

26. The projection optical system of claim 9, wherein the projection optical system is substantially telecentric on the second plane side.

27. The projection optical system of claim 17, wherein the projection optical system is substantially telecentric on the second plane side.

28. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 1 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

29. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 2 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

30. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 3 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

31. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 5 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

32. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 9 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

33. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 17 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

34. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 22 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

35. The exposure apparatus of claim 28, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

36. The exposure apparatus of claim 29, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

37. The exposure apparatus of claim 30, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

38. The exposure apparatus of claim 31, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

39. The exposure apparatus of claim 32, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

40. The exposure apparatus of claim 33, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

41. The exposure apparatus of claim 34, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.

42. A projection optical system for forming a reduced image on a first plane onto a second plane, comprising:

a first reflective image forming optical system that forms an intermediate image of the first plane, and a second reflective image forming optical system that forms an image of the intermediate image on the second plane, wherein:

the first reflective image forming optical system has, in order of an incidence of light from a side of the first plane, a first concave reflective mirror M1, an aperture stop, a second concave reflective mirror M2, a third convex reflective mirror M3, and a fourth concave reflective mirror M4, and

the second reflective image forming optical system has, in order of the incidence of the light from the side of the first plane, a fifth convex reflective mirror M5 and a sixth concave reflective mirror M6.

43. The projection optical system of claim 42, wherein a maximum incident angle A of a light beam to each of the reflective mirrors M1-M6 satisfies, at each of the reflective mirrors M1-M6, a condition:

$$A < 25°.$$

44. The projection optical system of claim 42, wherein at each of the reflective mirrors M1-M6,

$$\phi M / | R | < 1.0$$

is satisfied, where ϕM is an effective diameter of each of the reflective mirrors M1-M6 and R is a curvature radius of a reflective surface of each of the reflective mirrors M1-M6.

45. The projection optical system of claim 42, wherein a slope α of luminous flux from the first plane to the first reflective mirror M1 with respect to an optical axis of a main light beam satisfies

$$5° < | \alpha | < 10°.$$

46. The projection optical system of claim 42, wherein at each of the reflective mirrors M1-M6, the effective diameter ϕM of each of the reflective mirrors M1-M6 satisfies

$$\phi M \leq 700 \text{ mm}.$$

47. The projection optical system of claim 42, wherein a reflective surface of each of the reflective mirrors M1-M6 is formed rotationally symmetrical with respect to an optical axis of a main light beam and is aspheric, and

a largest order of an aspheric surface defining each reflective surface is equal to or more than 10th order.

48. The projection optical system of claim 42, wherein the projection optical system is substantially telecentric on the second plane side.

49. An exposure apparatus, comprising an illumination system for illuminating a mask provided on a first plane, and

the projection optical system of claim 42 for projecting and exposing a pattern of the mask onto a photosensitive substrate provided on a second plane.

50. The exposure apparatus of claim 49, wherein the illumination system has a light source for providing X rays as exposure light, and

the pattern of the mask is projected and exposed onto the photosensitive substrate by synchronously moving the mask and the photosensitive substrate with respect to the projection optical system.